ARGUMENTS/REMARKS

Claims 1, 4-8, 10-14, 16, and 18-19 are pending.

Interview Summary

The Applicant's Attorney would like to thank the Examiner for her time during the telephone interview on June 26, 2009, with Paul Stellman and me. Claim 1 was discussed with regards to Chen, Brown, and Chantre according to some of the comments below. No agreement was reached.

Arguments

The office action rejected claims 1, 4-8, and 10-14 under 35 U.S.C. 103(a) as being unpatentable over Chantre et al. (US 2001/0051413 A1) in view of Vallon et al (JVST A 1997), Chen (EP 0200951 A2), Brown et al. (US 2003/0186492 A1), and Yang et al. (US 6,451,647 B1). None of the cited references teaches or makes obvious using an etch chemistry of N_2, SF_6, and at least one of CHF_3 and CH_2F_2 to simultaneously etch doped and undoped regions of a polysilicon layer, as recited in claim 1.

Although Chen may teach an etch chemistry of N_2, SF_6, and CHF_3 to etch a polysilicon layer, this reference does not teach or suggest that such a break through etch would be able to simultaneously etch doped and undoped regions of a polysilicon layer. Page 4, lines 15-21, of the application states that etching doped and undoped regions simultaneously causes additional difficulties, since the doped and undoped regions have different etch characteristics that can cause undercutting or a non-vertical profile in one of the regions.

As the office action pointed out, Chen's N_2, SF_6, and CHF_3 etch chemistry may further teach etching "any sequence or number or [sic] layers of undoped polysilicon, doped polysilicon, and monocrystalline silicon." (col. 3, lines 51-56). However, this reference merely discloses that the above etch chemistry may be useful for sequentially etching multiple layers of undoped and doped polysilicon; it does not teach simultaneously etching both doped and undoped regions of a single polysilicon layer. Figure 2 illustrates Chen's etch process. As described in col. 3, lines 26-41, the n-

doped region 30 and the underlying p-doped region 32 are anisotropically and sequentially etched. Given Chen's disclosure and the drawing of Figure 2 depicting a sequential etch process, the Office Action failed to point out anything in the cited art that suggests that Chen's process successfully simultaneously etches doped and undoped regions of a polysilicon layer at the same rate and solves the problems of undercutting and non-vertical profiles. During the interview, the Examiner said that she would look to see if Chen teaches simultaneous etching somewhere else in Chen.

During the interview, Applicant's Attorney explained that an etch chemistry may etch different materials sequentially, but that does not show that the different materials can be simultaneously etched. In a sequential etch of different materials, the etch rate through the different materials may be different, but the etch rate of all the features will be the same, because all the features pass through the different materials. For simultaneous etching, some features go through one material (i.e. doped regions) while other features simultaneously go through another material (i.e. undoped regions). If the different materials have different etch rates then the features will be etched at different rates, which cause problems.

Brown et al. teaches using different etch processes in the doped and undoped polysilicon regions and in the main polysilicon etch, but this reference, as cited, does not teach or suggest Applicants' invention. Because Brown uses an etch chemistry of HBr/O_2 in etching the doped and undoped regions of the polysilicon (para. [0035]), the cited portions of Brown do not teach or suggest that Applicants' etch chemistry of N_2, SF_6, and at least one of CHF_3 and CH_2F_2 will successfully simultaneously etch doped and undoped regions of a polysilicon layer. In addition, although Brown teaches using a separate CH_3 or CH_2F_2 based chemistry to form a protective polymer layer on the exposed doped and undoped regions of the polysilicon (para. [0036]), <u>it would not be obvious to combine CH_3 or CH_2F_2 with N_2 and SF_6 to simultaneously etch the doped and undoped regions of the polysilicon layer</u>. Such a combination is not predictable, since in plasma processing various outcomes are unpredictable.

Brown teaches using a similar chemistry to the chemistry, claimed in claim 1, for the main etch of polysilicon, which is different from the chemistry of the break through etch, which simultaneously etches doped and undoped regions of polysilicon. Brown teaches that the HBR and O_2 recipe of Brown would successfully simultaneously etch doped and undoped regions. So there is

no motivation to use or try a different recipe to simultaneously etch doped and undoped regions. The N_2, SF_6, and at least one of CHF_3 and CH_2F_2 simultaneous breakthrough recipe of claim 1 is a very different recipe than the recipe of Brown. Because plasma etching is such a complex process, it is not obvious the such a different recipe would simultaneously etch doped and undoped regions. In addition, there is no motivation in Brown to use another recipe. For these reasons, it would not be obvious to use the recipe in Chen in the process of Brown to simultaneously etch doped and undoped regions.

The office action also failed to respond to Applicants' argument that it would not be obvious to combine the etch chemistry cited in the office action from col. 11, lines 20-22, 32-33, and col. 12, lines 7-10, of Yang with the teaching of Chantre, Vallon, and Chen to obtain the combination of the break through etch that simultaneously etches doped and undoped polysilicon regions, the main etch that etches completely through the polysilicon layer to the silicon germanium layer, and the silicon germanium etch, as recited in claim 1. The cited portion of Yang teaches that the etch process is able to equally etch through polysilicon and SiGe, therefore there is no motivation for using this step in a process with a separate SiGe step with a different etch chemistry.

For at least these reasons, claim 1 is not made obvious by Chantre et al. in view of Vallon et al., Chen, Brown et al., and Yang et al.

The office action rejected claims 16 and 18-19 under 35 U.S.C. 103(a) as being unpatentable over Brown et al. (US 2003/0186492 A1) in view of Chen (EP 0200951 A2) and Yang et al. (US 6,451,647 B1). As discussed above regarding claim 1, none of the cited references teaches or makes obvious using an etch chemistry of N_2, SF_6, and at least one of CHF_3 and CH_2F_2 to <u>simultaneously etch doped and undoped regions of a polysilicon layer</u>, as recited in claim 16.

Brown et al. may teach using different etch processes in the doped and undoped polysilicon regions and in the main polysilicon etch, but this reference, as cited, does not teach or suggest Applicants' invention. Because Brown uses an etch chemistry of HBr/O_2 in etching the doped and undoped regions of the polysilicon (para. [0035]), the cited portions of Brown do not teach or suggest that Applicants' etch chemistry of N_2, SF_6, and at least one of CHF_3 and CH_2F_2 will successfully simultaneously etch doped and undoped regions of a polysilicon layer. In addition, although Brown teaches using a separate CH_3 or CH_2F_2 based chemistry to form a protective

polymer layer on the exposed doped and undoped regions of the polysilicon (para. [0036]), it would not be obvious to combine CH_3 or CH_2F_2 with N_2 and SF_6 to simultaneously etch the doped and undoped regions of the polysilicon layer. Such a combination is not predictable, since in plasma processing various outcomes are unpredictable.

Although Chen may teach an etch chemistry of N_2, SF_6, and CHF_3 to etch a polysilicon layer, this reference does not teach or suggest that such a break through etch would be able to simultaneously etch doped and undoped regions of a polysilicon layer.

As the office action pointed out, Chen's N_2, SF_6, and CHF_3 etch chemistry may further teach etching "any sequence or number or [sic] layers of undoped polysilicon, doped polysilicon, and monocrystalline silicon." (col. 3, lines 51-56). However, this reference merely discloses that the above etch chemistry may be useful for sequentially etching multiple layers of undoped and doped polysilicon; it does not teach simultaneously etching both doped and undoped regions of a single polysilicon layer. Figure 2 illustrates Chen's etch process. As described in col. 3, lines 26-41, the n-doped region 30 and the underlying p-doped region 32 are anisotropically and sequentially etched. Given Chen's disclosure and the drawing of Figure 2 depicting a sequential etch process, the Office Action failed to point out anything in the cited art that suggests that Chen's process successfully simultaneously etches doped and undoped regions of a polysilicon layer at the same rate and solves the problems of undercutting and non-vertical profiles. Such a combination is not predictable, since in plasma processing various outcomes are unpredictable.

Thus it is not obvious that the chemistry of Chen would successfully etch in the process of Brown, and it would not be obvious to combine these references. For at least these reasons, claim 16 is not made obvious by the cited references and is allowable.

Dependent claims 4-8, 10-14, and 18-19 are also patentably distinct from the cited references for at least the same reasons as those recited above for the independent claims, upon which they ultimately depend. These dependent claims recite additional limitations that further distinguish these dependent claims from the cited references.

For example, claim 5 recites that the stack further comprises a seed silicon layer under the silicon germanium layer, where the SiGe etch etches through the seed layer. The office action failed

to point out anything that etches both the SiGe layer and the seed layer. For at least these reasons, the dependent claims are not made obvious by the cited references.

Applicants believe that all pending claims are allowable and respectfully request a Notice of Allowance for this application from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at telephone number (408) 255-8001.

Respectfully submitted,
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